



## Questions & Answer Session 2

Please type your questions in the Question Box. We will try our best to get to all your questions. If we don't, feel free to email Amita Mehta ([amita.v.mehta@nasa.gov](mailto:amita.v.mehta@nasa.gov)) or Kel Markert ([kel.markert@nasa.gov](mailto:kel.markert@nasa.gov)) your question(s).

Question 1: So all input data should be in a raster format?

Answer 1: Yes, all the data are required at each of the VIC grid points. They're all required to be in raster format. At each grid point you - VIC is a base model - so for each point you need raster data. They don't have to be in raster format for running because you'll be making a time series at each grid point. We'll go into that more next week. If you do have gauge data for meteorological info you do an interpolation to convert it into a raster format

Question 2: What is sub daily data ?

Answer 2: Sub-daily data are hourly, 3-hourly, or 6-hourly data. These are required for energy balance as solar radiation reaching the surface changes during a day. For water balance averaged daily radiation may be used.

Question 3: Is there a video how to install exactly in Linux using commands?

Answer 3: We are going see this next week. Will add in small section on installing VIC.

Question 4: Why get elevation from satellite? Isn't it static data?

Answer 4: It is a static data and it is specified once from SRTM. Using SRTM helps as it has continuous spatial coverage. SRTM=shuttle radar topography mission collected from space shuttle radar. Available at different resolutions starting from 30 m all the way to 250 m.

Question 5: Will you be providing code (R, Python) to download, process, and extract info from these climate datasets?

Answer 5: There are Python scripts to prepare and reformat data after you download data from NASA sites we will be covering this next week. Today's presentation will help you in going through steps for downloading data. Scripts are mostly from pre-processed, downloaded data. Today's presentation was to show you how to get to the data and download it, since that is the first step. You then convert that data into



VIC input format. For downloading data you really will have to go through some of the steps from today.

Question 6: How can vegetation parameter file can be created or modified for a particular basin?

Answer 6: Using NASA Earthdata you can choose any area where you need the vegetation parameters (there is a demonstration video in today's presentation)

Did this for the Mekong basin, but you can do a subset for your own region. You saw in Earthdata where we provided long/lat covering the river basin, and you can do the same thing for your own region

Question 7: it's possible run VIC model on Google Earth Engine?

Answer 7: Not yet! Kel did talk to some developers for GEE and the way it's set up, it isn't very nice - it doesn't play well with hydrology models. So if we do link VIC with GEE, it would be some sort of linkages between getting the data on Earth Engine, running the model, and pushing it back. MODIS data is available in GEE. Prepping data for input on GEE and then run the model, and then push the results back to GEE.

Question 8: From SRTM we can get 30m DEM data? <http://srtm.csi.cgiar.org/> from here we are not getting 30m DEM data...

Answer 8: Yes, you can use GDEx for getting the 30m SRTM data (there is a slide in the presentation about this). Since VIC only uses low resolution data we are using 250m data. CGIAR does not have 30 m data, it has 90 m data. In the presentation, there was a slide about GDACS, which does have 30 m resolution data. We are using CGIAR because VIC cannot be run at very high resolution (like 30 m) and 250 m are directly available from CGIAR. We used 250 m data for convenience.

Question 9: Can you use higher resolution DEM for watersheds that are relatively flat.

Answer 9: Yes you can - and specify appropriate elevation bands. If the watershed is relatively flat it may not matter a lot and you can use mean elevation I believe.

Kel: It's a great question. Really that depends on DEM accuracy. From my experience, SRTM has pretty large errors - it can be on the order of 30 m as a maximum. If you have really flat flood plains, then your error that you're getting with high res SRTM data can inhibit or introduce errors into your analysis. So we see this quite often with Mekong flood plains. So it really depends on accuracy of your DEM and I would caution using the highest res DEM and assuming it's the most accurate because that may not be the case.



Question 10: What is the minimum size watershed for which the VIC model could operate? Would the minimum size be the smallest resolution of the input parameters?

Answer 10: VIC works best at resolution  $>3$  km -- so not appropriate for watershed small than that. Kel: I would suggest that it's - you would need a couple grid points.

Amita: I would say about 12 km would be a limit of the watershed. Kel: I'll show this in the next session, but when we set up the routing scheme, we'll take fractional coverage of a watershed into account. Even if your watershed only covers a few pixels, the model will still account for that. You need at least a couple grid cells. I would make sure you don't do it for very small watersheds.

Question 11: is it possible to refer any books regarding VIC?

Answer 11: There are books on hydrological modeling but not specifically on VIC. But there are many publications about VIC.

Question 12: In previous session you suggest that Grid cell size should be greater than 3 km. So, How is the Grid cell size decided ?

Is there any relationship between watershed size ? or on what variable it depends on for getting acceptable result? Is it ok to use VIC Model for river basin of around 20000 sq.Km.?

Answer 12: 3 km resolution limit is based on the model physics. The assumption that vertical fluxes of water are much larger than horizontal - that assumption holds at grids that are about 3 km or higher. That's why that's the limit. Kel: And when you're setting up your model, too - deciding what grid cell to run - I typically define the grid cell size as the size of the precipitation data inputs. E.g., we have an IMERG dataset that is 0.1deg resolution, so we can set up the model at .1 degree resolution. How the precip data is interpreted is aerial average for that one pixel, and that's directly relatable to how the VIC model needs precip inputs. For e.g., if you set up the model at 3 deg resolution and you run the model using IMERG or what-have-you, you'll get the same result. A nearest neighbor interpretation for that. You're not really adding more information from that

Question 13: Is it possible to acquire Wind and temperature input variables (from the source used in this example) in near real time for operational purposes?

Answer 13: There is analysis that provides NRT data from NOAA and NCMWF and they do that - and also you can use forecast model so that you have data when you need it. But yes, there are NRT analysis. There is still some latency in that data will be on the website and you download and then preprocess, but they are available.



Question 14: if I have a 5km DEM what is the optimal elevation band file, land cover, vegetation parameter file or vegetation library spatial resolution to solve properly most of the physical processes in the watersheds.

Answer 14: So, if you have a 5 km DEM then that's fairly coarse resolution. I would probably scale up the grid cell size to probably .25 degrees or greater because the - you aren't getting much variation in those elevation bands if you go lower than .25 deg. If you do want to capture model physics or small scale model physics, you'll want to input higher res data. 5 km DEM sounds like a global application to me.

Question 15: What if the much spatial variability in soil data is not present for the river basin? or You can consider that there is only one soil type is present (low resolution satellite data) then the result of VIC model is acceptable in this case? Please suggest.

Answer 15: Yes. So that is acceptable - we'll see next week too when we calibrate the model, the model it's assumed the calibrated parameters are lumped parameters. (They're the same for each sub-watershed) If that's the case and you have a small sub-watershed and you don't have the soil data needed for that sub watershed you can consider it lumped. But the VIC model still runs on a grid basis. You're just assigning each grid the same soil properties

Question 16: why you take LAI at 1 km resolution as you say earlier VIC is run above 3 km resolution?

Answer 16: BC LAI is available at 1 km resolution. Best to get the data at resolution and change it to using for VIC model. As you know, for land cover, we use 500 m bc that's the native resolution for that. You can do averaging - if it's 1 km you want. But we decided if you don't specific output pixel size, it keeps native resolution. In LAI case, it'll be 1 km. Then we can just convert it to VIC. You can regrid it, but we decided not to do that. We decided to use a script to use everything on the - but that's next week's presentation.



Introduction to Using the VIC Hydrologic Model with NASA Earth  
Observation  
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